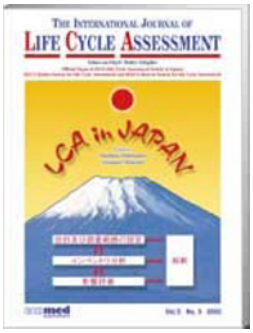

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The Institute of Life Cycle Assessment, Japan (ILCAJ) was established in October 2004. The goal of ILCAJ is to promote academic activities related to life-cycle thinking and to share expert knowledge with colleagues from wide-ranging backgrounds. Professor Ryoichi Yamamoto, University of Tokyo, has taken responsibility as Chairman of ILCAJ.

In April 2005, ILCAJ has successfully established its publication organ (in Japanese), The Journal of Life Cycle Assessment, Japan (J LCA Jpn). The issues appear every three months. J LCA Jpn publishes peer-reviewed research articles, commentaries & discussions, (technical) reports, lecture notes, and presentations of research groups in Japan, among other.In Int J LCA 12 (6) 348–350, we were happy to announce the collaboration between Int J LCA and J LCA Jpn for the purpose of exchanging knowledge, new insights, experiences and information across the different languages. The **Corner: JLCA Jpn** aims to be a bridge between the LCA community of Japan and of the entire world.

All abstracts of **research articles** as well as **commentaries & discussions** published in J LCA Jpn will simultaneously appear in Int J LCA, Corner: JLCA Jpn, in order to introduce Japanese activities to our readers. In addition, some selected research papers from J LCA Jpn will be submitted to Int J LCA for publication following peer-review. We hope that this collaboration will stimulate the global exchange of information through professional pathways.

The following abstracts were published in J LCA Jpn Vol. 4, No. 1.

Commentaries and Discussions

LCA Analysis of a Detached Wooden House: Problem and Solution on Analysis

Hideto Kakita[1], Hiroshi Yagita[2], Nobuhiko Narita[3], Hiroyuki Oba[4], Masahiko Kimura[5], Ryohsuke Aoki[6] and Atsushi Inaba[7]

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Objective. The case study of LCA analysis of a detached wooden house from cradle to grave by Process Analysis Method was performed as the second LCA Project by NEDO (New Energy and Industrial Technology Development Organization). The inventory data of a two-by-four system house and of an aluminum sash were collected in detail. For this two-by-four house, several kinds of aluminum sashes with different sizes were used as windows or terraces. However, we obtained only one inventory data set of the most common sash. It is necessary to estimate the CO_2 emission of unknown, different size sashes from the known inventory data of the most common sash. The degree of data coverage is very important because the degree of precision of the analysis depends on it. The effect of data coverage on the precision of inventory analysis was performed for an aluminum sash, heat insulating aluminum sash and detached wooden house. The 1st objective is to estimate the CO_2 emission of unknown, different size sashes from the known inventory data of the most common sash. The second objective is to make clear the effect of data coverage on the precision of inventory analysis.

Results and Discussion. For the first objective, several estimation methods were studied and the method that uses the power function of the ratio of perimeter was found to be the most precise and simple method. For the second objective, in the case of both aluminum sashes, about 70 weight % of degree of data coverage was enough to obtain 90% of CO_2 emission. On the other hand, in the case of the house, 90% CO_2 emission was obtained by 97 weight % of data coverage. In the case of the house, if the data coverage were calculated by accumulating materials weight in descending order of CO_2 emission, then 90% of CO_2 emission would be attained by 90 weight % data coverage. It is important to collect inventory data with the help of the information about the CO_2 emission factor of materials.

Conclusions. In the case of aluminum sashes, the CO_2 emission by production of any sash was found to be able to estimate from the only one known sash by the method that uses the power function of the ratio of perimeter. For collecting inventory data effectively, it is important to collect them in consideration with weight and also the CO_2 emission factor of materials.

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Present Situation of LCA Studies in the Architectural Field

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Objective. Briefing on the present situation of LCA studies in the architectural field.

Results and Discussion. The ecological studies of the architectural field in Japan had started on the era of air pollution issues in the 1960s. The studies noted abbove had progressed into the LCA studies in the 1990s by way of the trigger of the oil crisis in the 1970s and the ozone depletion issues in the 1980s. Main institutions of the LCA studies in the architectural field in Japan are the 'Architectural Institute of Japan', 'The Society of Heating, Air Conditioning and Sanitary Engineers of Japan', 'The Institute to Electrical Installation Engineers of Japan' and the 'Institute for Building Environmental Energy', etc. Major architect offices, major contractors and major housing companies have performed the studies up to now. Environmental assessment methods for building, based on LCA, have been proposed. They are BREEAM (UK, 1990), BEPAC (Can, 1993), LEED (USA, 1996), GB Tool (International, 1998), NABERS (Aus, 2001) and CASBEE (Jpn, 2002).

Conclusions. The LCA studies in the architectural field are advancing actively.

Current Situation of Combined LCA and LCC Method of Buildings Used by National/Local Governments and Private Companies

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The research on the LCA method of buildings started in 1990 as an activity of the Architectural Institute of Japan, and it became an LCA guideline of buildings. By using this guideline, the cost effectiveness evaluation tool to mitigate climate change was developed and applied by the public building department, the Ministry of Land, Infrastructure and Transport as a operation tool for a Green government design guideline in 1998. A similar evaluation tool that suits each climate of various regions was developed and applied by local governments and private companies. As well as LCA, the comprehensive assessment system for building environmental efficiency named 'CASBEE' was developed and supported by the Ministry of Land, Infrastructure and Transport. Since 2004, more than 1300 buildings have been assessed and ranked by national government, local governments and private companies using CASBEE tool and, in 2007, CASBEE was revised to contain simplified LCA method limited to $LCCO_2$ calculation for all kind of buildings such as detached houses and large-scale commercial buildings. This paper describes current situation on these projects of which the author has taken charge.

Assessment of Resource Consumption and Waste Generation for Buildings

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Objective. Preventing global warming has become a major social issue. So, in life cycle assessment (LCA) of buildings, $LCCO_2$ focusing on CO_2 is often used as an assessment index. Additionally, the establishment of sustainable society for resources is another major issue in Japan. The building construction industry has seen problems in the consumption of large amounts of resources during building construction and the generation of massive waste at the time of demolition. To curtail them, it is being called for to use recycled resources upstream of the processes and reduce, reuse, and recycle waste material downstream. So, LCA, which is able to estimate resource sustainability, became necessary in the building sector.

Results and Discussion. Firstly, a general review of LCA studies in the building sector will be reported for these issues. Then, an LCA study by the Architectural Institute of Japan (AIJ) will be reported in detail. An LCA study for buildings by AIJ has been continued since 1990 and a useful assessment tool, which is called 'the AIJ-LCA tool', has been developed. This tool has been widely used in the building sector and has made some influence. But this tool is mainly used to assess $LCCO_2$. On the other hand, this tool was revised to estimate resource consumption and waste generation in 2006. This report will give an outline of resource sustainability assessment functions of this tool and show a case study.

Conclusions. New indices, which are life cycle resource (LCR) and life cycle waste (LCW), were introduced to estimate resource consumption and waste generation. By a case study, these indices were shown as useful to estimate resource sustainability.

Evaluation of Environmental Improvements by Urban Heat Islands Countermeasures Based on Life Cycle Thinking

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Background and Objectives. It is difficult that countermeasures against urban heat islands (UHI) are installed really effectively because various environmental impacts by UHI depend on time, season, and location. However, we think that research and development of installation methodology of UHI countermeasures based on life cycle thinking makes their really effective installation possible.

Results and Discussion. One of the UHI countermeasure studies based on life cycle thinking is a simultaneous evaluation of an air temperature reduction effect and an $LCCO_2$ reduction effect by UHI countermeasures using life cycle inventory analysis (LCI). Although air temperature decrease in summer reduces energy consumption for cooling, the decrease in winter increases energy consumption for heating and installation and operation of UHI countermeasures themselves emit CO_2. From the results of the study, we can install UHI countermeasures so as not to promote global warming. The other result of studies based on life cycle thinking is an environmental impact assessment of UHIs based on a framework of life cycle impact analysis (LCIA). From the results of the study, we can assess when and where UHI has an impact on a human society.

Perspectives. We wish that life cycle thinking also spreads over UHI countermeasure studies and UHI studies since real environmental impact reductions are widely being achieved.

A Discussion about Influences of Location of Buildings on Environmental Load

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Objective. This paper aims 1) to grasp the mechanism for impacts of 'location of buildings' on environmental load, 2) to review existing research, and 3) to examine the environmental load by applying LCA in the scale of urban areas in a case city.

Results and Discussion. There are two types of approaches for estimating the environmental load generated by buildings. The one is a micro level approach to target each building or town block, and the other is a macro level approach to target the urban area or region. The former approach can estimate the environmental load induced by each building or town block, e.g., related transport activity. The latter sets the boundary for estimating it from the various types of activities which can be changed according to the location of buildings. The literature reviews show that the environmental load from the transport sector has been studied in the transport engineering field, and that from the domestic sector has been studied separately in the architectural field. However, it is very important to estimate the emission from the transport sector when examining the location of buildings with the view of environmental load. Our case study applying LCA in an actual city indicates that there might be the correlation between the geographical distribution of CO_2 emission and that of population, and that the CO_2 emission per person is larger in dense districts than in suburban areas. These results imply that the introduction of a compact city has the potential to reduce the Life Cycle CO_2 emission of buildings.

Conclusions. This paper concludes the necessity of the framework for evaluating the impacts of both 'the locational distribution of buildings in urban areas' and 'the types of buildings' on the environmental load throughout the change in life- and work-style. An LCA approach is effective for this. Further, a collaboration between the research in the transport sector and domestic sector is needed.

Research Articles

LCA Analysis of a Detached Wooden House

Hideto Kakita[1,2], Hiroshi Yagita[1,3]*, Nobuhiko Narita[4,5], Akitoshi Katoh[6], Masahiko Kimura[6], Ryohsuke Aoki[4] and Atsushi Inaba[1,7]

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Objective. A detached house LCA Analysis from cradle to grave via a Process Analysis Method is rare, because huge amounts of inventory data related to resources and parts are required and the background data are not enough to link with the foreground data. The purpose of this study, that was performed as a case study of the second LCA Project by NEDO (New Energy and Industrial Technology Development Organization), is to collect inventory data of a detached wooden house in detail with the LCI analysis via a Process Analysis Method, and to estimate the global warming impact of the detached house through its life cycle. The influence of the energy saving performance and disposal scenarios are also examined.

Results and Discussion. This analysis made the following facts clear. In the construction stage, the highest energy performance house emits the largest amount of CO_2 because of using the most efficient insulator and double glazing fittings. But, several years after construction, the power saving effect of air conditioning recovers the negative effect of the construction stage. The living stage emits the largest amount of GHG (CO_2eq.) among the construction, maintenance, living and disposal stage. In the disposal scenarios, if materials are recycled as much as possible, the subtraction effect lowers the life cycle global warming impact.

Conclusions. The LCI analysis of the detached house through its life cycle via a Process Analysis Method was performed and the global warming impact was estimated. The influence of the energy saving performance and disposal scenarios are also examined. The results of this study will make it possible to research an insulation effect of houses in cold regions or the effect of life-time on the environmental load, and many other subjects. However, to achieve these studies, it is essential to enrich the background data.

Future Prospects of Environmental Efficiency Related to Wastewater Treatment Systems in Shiga Prefecture

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Objective. It is forecasted that the population of Shiga prefecture should increase until 2030. There is an apprehension that environmental load impact should also increase by population increase. In this study, we estimated the future prospect of environmental load related to wastewater treatment systems in Shiga prefecture. The target year is 2003 and 2030. We proposed a new environmental efficiency indicator based on the ratio of water pollutant reduction to greenhouse gas (GHG) emission, and evaluated wastewater treat-

ment systems by utilizing our new environmental efficiency indicator. Our estimation considers sewerage, a agricultural community effluent treatment facility, a combined household wastewater treatment facility and a night soil treatment facility.

Results and Discussion. In 2003, 70% of the total GHG related to wastewater treatment systems in Shiga prefecture was emitted from sewerage. On the other hand, 80% to 85% of the total GHG is estimated to come from sewerage in 2030. It is estimated that the introduction of advanced treatment system accompanying water pollutant reduction (COD. 4%, T-P. 15%, T-N. 1%) should cause a nearly 30% increase in GHG emission. In focusing on an environmental efficiency indicator based on the ratio of water pollutant reduction to GHG emission, the efficiency of sewerage is 50% to 80% higher than that of other wastewater treatment systems.

Conclusions. In this study, we estimated the future prospect of environmental load and environmental efficiency related to wastewater treatment systems based on the lifecycle comparison of 8 scenarios considering future technologies and social trends such as water saving lifestyle. Our estimated results showed that the introduction of an advanced treatment system for sewerage possibly results in a nearly 30% increase in GHG emission. On the other hand, it was shown that a water saving lifestyle should cause a definite reduction in GHG emission. We investigated a scenario in which the introduction of an advanced treatment system and a water saving lifestyle would spread. In comparing an estimated result of this scenario with the present conduction, we could show several advantages of the environmental efficiency proposed in this study.

LCA Analysis of PET Bottle Recycling by Using a Proposed Concept of Social Energy Consumption

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Objective. The 'bottle to bottle recycling' of a PET bottle by chemical process, hydrolysis and re-synthesis of PET resin, was put into practical use in Japan in April of 2004, and this method was regarded as one of the most promising routes of PET bottle recycling. There are, however, several options of PET bottle recycling that should be examined as to whether they are really useful or not. In this study, LCA analysis was performed to estimate the effectiveness of several alternatives of PET bottle recycling. A new concept of 'Social Energy Consumption', defined as sum of energy inputs for production plus feed stock energy minus total energy loss in our society during the use and recycling of PET bottles, was proposed and used as a criteria for estimating the effectiveness of the PET bottle recycling. In other words, energy equivalent of resource conservative quantity was used for an estimation of recycling, which is a main characteristic of this study.

Results and Discussion. Several case studies were carried out to examine the adequacy of assumed values as well as the estimation procedure adopted in this study. As a result, the reliability of the values and method was confirmed. Results of the case studies indicated that the advantage of the chemical recycling for bottle to bottle is not so much larger than was to be expected as compared with that of material recycling for other products, because energy input for chemical recycling is rather large, although the difference in the quality of products is not taken into account. And it was also found that bottle reproduction from flakes obtained directly by crushing used PET bottle has a better potential advantage, meaning that this recycle route will be worthy of serious consideration, although this is not practical from a hygienic point of view in present-day Japan due to the ministerial regulations.

Conclusions. Thus, there should be more emphasis on the necessity of wide-ranging discussions on the recycling of PET bottles based on objective and quantitative LCA investigations from the stand point of, not only CO_2 emission, but the social utility of repeated use of petroleum resources.

Evaluation Method of Mechanical Recycling and Case Studies Based on Life Cycle Inventory Analysis

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Objective. In this study, we discussed the evaluation method of mechanical recycling based on life cycle inventory analysis. The CO_2 reduction effect was considered as an example for the environmental burden of the evaluation and the method was applied to typical cases.

Results and Discussion. In case of closed-loop recycling, such as aluminum can recycling, three factors are important for the evaluation: the unit CO_2 emission from the processes with and without recycling, and the recycling rate. Meanwhile, in case of an open-loop (cascade) recycling, it is essential to make equal functional units between the two scenarios. In this paper, we introduced performance ratio, which shows how much material is required to fulfill the defined unit function. Since a product from cascade recycling can be different from the corresponding original product in many aspects, like material composition, weight, and heating value, the CO_2 emission may change depending on the subsequent processes like waste treatment processes.

Conclusions. In each case of closed-loop recycling and cascade recycling, the CO_2 reduction effect per recycling is a key gauge. The discussions on the evaluation method in this paper will contribute to knowledge concerning the points for an improvement in efficiency of mechanical recycling.